

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1. (Previously Presented) A position sensing and control apparatus comprising:
a first supply voltage source supplying a first supply voltage;

a sensor powered by said supply voltage and operatively connected to a first member moveable relative to a second member to produce a voltage representative of the position of said first member relative to said second member; and

a voltage to current converter having a reference voltage supply for converting the voltage output of said sensor to a current wherein said first supply voltage has a ratiometric relationship with said reference voltage.

Claim 2. (Previously Presented) A position sensing and control apparatus according to claim 1 further comprising:

a storage memory for storing values of said current representative of a state of a respective sensor; and

a control circuit for controlling the movement of said first member, arranged to move said first member until said voltage to current converter output is substantially the same as a said stored value of current.

Claim 3. (Original) A position sensing and control apparatus according to claim 1 further comprising:

A voltage detector for detecting said first supply voltage that prevents said first supply voltage from being supplied to said sensor when a greater than predetermined voltage is detected.

Claim 4. (Previously Presented) A position sensing and control apparatus according to claim 3 wherein said voltage detector further comprises a switch interposed between said control circuit and said first supply voltage source used to isolate said control circuit and said supply voltage source when said first supply voltage is smaller or greater than predetermined voltages.

Claim 5. (Previously Presented) A position sensing and control apparatus according to claim 4 wherein said switch comprises a transistor, the base of which is connected to and controlled by an output voltage of said voltage detector.

Claim 6. (Original) A position sensing and control apparatus according to claim 1 wherein said sensor is a Hall Effect device.

Claim 7. (Previously Presented) A position sensing and control apparatus according to claim 1 wherein said voltage to current converter comprises an operational amplifier having a positive and negative input for receiving a voltage output from said sensor at said positive input and an output of said operational amplifier being high when said positive input is greater than said negative input, the output of said operational amplifier being input to the base of an emitter follow transistor, the emitter of which is connected to a resistive circuit to ground and above which a voltage feedback circuit to said negative input of said operational amplifier is provide, wherein as said feedback voltage reaches the value of said input voltage to said positive input, the output voltage of said operational amplifier decreases until said positive and negative voltage inputs are the same the result of which there is, as a result of the ratiometric relationship between the reference between said first supply voltage of said sensor and said reference voltage supply of said voltage to current converter, the current through said resistance circuit is representative of said sensor position.

Claim 8. (Previously Presented) A position sensing and control apparatus according to claim 7 wherein the collector current of said emitter follower transistor is substantially the same as said current through said resistance circuit.

Claim 9. (Cancelled)

Claim 10. (Currently Amended) A position sensing and control device for sensing and controlling the position of a moveable member with respect to a stationary member, said device comprising:

a sensor mounted to one or both of the moveable member and the stationary member, said sensor being responsive to a supply voltage signal and providing a sensor voltage signal indicative of the position of the moveable member relative to the stationary member; and

a voltage to current converter responsive to the sensor voltage signal, said voltage to current converter converting the sensor voltage signal to a representative current signal to provide an indication. ~~The device according to claim 9~~ wherein the voltage to current converter includes a comparator responsive to the sensor voltage signal and a feedback voltage signal, said comparator outputting a comparator voltage signal if the sensor voltage signal is greater than the feedback voltage signal.

Claim 11. (Previously Presented) The device according to claim 10 wherein the voltage to current converter further includes an emitter follower bipolar transistor and a resistor coupled to an emitter terminal of the transistor, said current signal being provided at a collector terminal of the transistor, wherein a base terminal of the transistor is responsive to the comparator voltage signal and the feedback voltage signal is provided at the emitter terminal of the transistor, and wherein the feedback voltage signal increases as the comparator voltage

signal increases so that the difference between the sensor voltage signal and the feedback voltage signal is reduced.

Claim 12. (Currently Amended) A position sensing and control device for sensing and controlling the position of a moveable member with respect to a stationary member, said device comprising:

a sensor mounted to one both of the moveable member and the stationary member, said sensor being responsive to a supply voltage signal and providing a sensor voltage signal indicative of the position of the moveable member relative to the stationary member;

a voltage to current converter responsive to the sensor voltage signal, said voltage to current converter converting the sensor voltage signal to a representative current signal to provide an indication of the position of the moveable member; and

~~The device according to claim 9 further comprising~~ a voltage detection circuit for detecting the supply voltage signal, said voltage detection circuit including a voltage detector and a switch, said voltage detector determining whether the supply voltage signal rises above a first predetermined voltage and falls below a second predetermined voltage, said voltage detector causing the switch to turn off the supply voltage signal to the sensor if the supply voltage signal rises above the first predetermined voltage and causes the supply voltage signal to be applied to the sensor if the supply voltage signal falls below the second predetermined voltage.

Claim 13. (Previously Presented) The device according to claim 12 wherein the switch is a bipolar transistor, wherein the detector is coupled to a base terminal of the bipolar transistor, and wherein the supply voltage signal is transferred to an emitter terminal of the bipolar transistor if the supply voltage signal is below the first predetermined voltage.

Claim 14. (Cancelled)

Claim 15. (Currently Amended) A position sensing and control device for sensing and controlling the position of a vehicle mirror with respect to a mirror housing, said device comprising:

a sensor mounted to one or both of the vehicle mirror and the mirror housing, said sensor being responsive to a supply signal and providing a sensor voltage signal indicative of the position of the vehicle mirror relative to the mirror housing, and

a voltage to current converter responsive to the sensor voltage signal, said voltage to current converting the sensor voltage signal to a representative current signal to provide an indication of the position of the vehicle mirror. ~~The device according to claim 9 wherein the movable member is a vehicle mirror and the stationary member is a mirror housing.~~

Claim 16. (Currently Amended) A position sensing and control device for sensing and controlling the position of a moveable member with respect to a stationary member, said device comprising:

a sensor mounted to one or both the moveable member and the stationary member, said sensor being responsive to a supply voltage signal and providing a sensor voltage signal indicative of the position of the moveable member relative to the stationary member;

a voltage to current converter responsive to the sensor voltage signal, said voltage to current converter converting the sensor voltage signal to a representative current signal to provide an indication of the position of the moveable member; and

~~The device according to claim 9 wherein an output voltage of the device~~ indicative of ~~[[is]]~~ a ratio of the supply voltage signal and a reference voltage signal.

Claim 17. (Previously Presented) A position sensing and control device for sensing and controlling the position of a vehicle mirror with respect to a mirror housing, said device comprising:

a source of a supply voltage signal;

a voltage detection circuit responsive to the supply voltage signal, said voltage detection circuit turning off the supply voltage signal if the supply voltage signal is above a first predetermined voltage and turning the supply voltage signal back on if the supply voltage signal falls below a second predetermined voltage;

a sensor mounted to the mirror, said sensor being responsive to the supply voltage signal from the detection circuit and providing a sensor voltage signal indicative of the position of the mirror relative to the mirror housing; and

a voltage to current converter responsive to the sensor voltage signal, said voltage to current converter converting the sensor voltage signal to a representative current signal to provide an indication of the position of the mirror, said voltage to current converter including a comparator responsive to the sensor voltage signal and a feedback voltage signal, said comparator outputting a comparator voltage signal if the sensor voltage signal is greater than the feedback voltage signal.

Claim 18. (Previously Presented) The device according to claim 17 wherein the voltage to current converter further includes an emitter follower bipolar transistor and a resistor electrically coupled to an emitter terminal of the transistor, wherein a base terminal of the transistor is responsive to the comparator voltage signal and the feedback voltage signal is provided at the emitter terminal of the bipolar transistor, and wherein the feedback voltage signal increases as the comparator voltage signal increases so that the difference between the sensor voltage signal and the comparator voltage signal is reduced, said current signal being provided at a collector terminal of the transistor.

Claim 19. (Previously Presented) The device according to claim 17 wherein the voltage detection circuit includes a voltage detector and a switch, said voltage detector

determining whether the supply voltage signal is above the first predetermined voltage and below the second predetermined voltage, said voltage detector causing the switch to turn off the voltage supply signal to the sensor if the supply voltage signal rises above the first predetermined voltage and causes the supply voltage signal to be applied to the sensor if the supply voltage signal falls below the second predetermined voltage.

Claim 20. (Previously Presented) The device according to claim 19 wherein the switch is a bipolar transistor, wherein the supply voltage signal from the detector is coupled to a base terminal of the bipolar transistor, and wherein the supply voltage signal is transferred to an emitter terminal of the bipolar transistor if the supply voltage signal is below the first predetermined voltage.